1049.01

Industrial Exposure and Control Technologies for OSHA Regulated Hazardous Substances

U.S. Department of Labor
Elizabeth Dole, Secretary
March 1989

Volume I of II
Substances A-I

Occupational Safety and Health Administration
John A. Pendergrass, Assistant Secretary

Chromium (VI) compounds
(CAS NUMBER: VARIES ACCORDING TO COMPOUND)

SYNONYMS

Synonyms vary depending on specific compound.

TRADE NAMES

NONE

DESCRIPTION OF SUBSTANCE

Hexavalent chromium compounds include chromium trioxide (also known as chromic anhydride, chromic acid, or chromium (VI) oxide), the anhydride of chromic acid chromates (e.g., sodium chromate (VI)), dichromates (e.g., sodium dichromate (VI)), and polychromates.

HEALTH EFFECTS

Certain hexavalent chromium compounds have been demonstrated to be carcinogenic on the basis of epidemiological investigations on workers and experimental studies in animals. In general, hexavalent chromium compounds tend to be of low solubility in water. They may be subdivided into two subgroups: a) water-soluble hexavalent chromium compounds: these include chronic acid and its anhydride and the monochromates and dichromates of sodium, potassium, ammonium, lithium, cesium, and rubidium; and b) water-insoluble hexavalent chromium compounds: these include zinc chromate, calcium chromate, lead chromate, barium chromate, strontium chromate, and sintered chromium dioxide. [ACGIH, P. 139, 1986]
The known harmful effects of chromium in humans have been attributed to the hexavalent form, and it has been speculated that the biologic effects of hexavalent chromium may be related to the reduction to trivalent chromium and the formation of complexes with intracellular macromolecules. Systemic toxicity to chromium compounds occurs largely from accidental exposures, occasional attempts to use chromium as a suicidal agent, and previous therapeutic uses. The major acute effort from ingested chromium is acute renal tubular necrosis. Exposure to chromium, particularly in the chrome production and chrome pigment industries, is associated with cancer of the respiratory tract. As early as 1936, German health authorities recognized cancer of the s, 1% of those exposed 3-10 years, 69.6% of those lung among workers exposed to chromium dust. A later report described 109 cases of cancer in the chromate-producing industry, 11 cases in the chrome pigment industry, and two cases in other industries. The greatest risk of cancer is attributed to exposure to acid-soluble, water-insoluble hexavalent chromium as occurs in the roasting or refining process. Other studies have attributed the greater risk of cancer to exposure to slightly soluble

hexavalent compounds rather than trivalent chromium compounds. Hexavalent chromium is corrosive and causes chronic ulceration and perforation of the nasal septum. It also causes chronic ulceration of other skin surfaces, which is independent of hypersensitivity reactions on skin. Allergic chromium skin reactions readily occur with exposure and are independent of dose. Whether chromium compounds cause cancer at sites other than the respiratory tract is not clear. A slight increase in cancer of the gastrointestinal tract has been reported in some studies, but each involved only small groups of workers. Animal studies support the notion that the most potent carcinogenic chromium compounds are the slightly soluble hexavalent compounds. Studies on in-vitro bacterial systems, however, show no difference between soluble and slightly soluble compounds. [CASARETT AND DOULL'S TOXICOLOGY, PP. 597-598, 1986]

TOXICITY/EXPOSURE LIMITS

NFPA RATING - Varies with compound.

TOXICITY HAZARD RATING - Varies with compound.

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH - 30 mg/m3 (for non-carcinogenic Cr(VI) compounds *) [NIOSH, 1987]

OSHA PEL - 0.1 ppm;Ceiling - chromic acid and chromates, as Cr

ADOPTED ACGIH/TLV - 0.50 mg/m3;TWA - certain water-soluble Cr(VI) compounds, as Cr
0.50 mg/m3;TWA - certain water-insoluble Cr(VI) compounds, as Cr (carcinogens - Appendix A1a)

NIOSH/REL - 0.010 mg/m3;TWA - carcinogenic Cr(VI) compounds
0.025 mg/m3;TWA - non-carcinogenic Cr(VI) compounds *
0.050 mg/m3;STEL - 15 minutes

INDUSTRY USE DATA

Chromium metal is used to manufacture stainless and heat-resisting steel and alloy steel. Chromium and its compounds are also used in refractories, drilling muds, the production of chromic acid and specialty chemicals; as a constituent of inorganic pigments, a sensitizer in the photographic industry, electroplating cleaning agents in the metal finishing industry, mordants in the textile industry; in nuclear and high-temperature research, in catalytic manufacture, and in fungicides and wood preservatives.

NIOSH 1982 NATIONAL OCCUPATIONAL EXPOSURE SURVEY

SIC CODE	INDUSTRY NAME	TOTAL ON PAYROLL	TOTAL EXPOSED	PERCENT EXPOSED
3324	STEEL INVESTMENT FOUNDRIES	527	96	18.22

NIOSH 1972 NATIONAL OCCUPATIONAL HAZARD SURVEY

NONE

OSHA/EXPOSURE DATA

NONE

ENGINEERING CONTROLS

General ventilation; local exhaust ventilation; hood; enclosure of process or worker.

PERSONAL PROTECTIVE EQUIPMENT

Respiratory protection should be as follows: CARCINOGENIC Cr(VI): At any detectable concentration: any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode or any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus and operated in pressure-demand or other positive pressure mode. Escape: any air-purifying full facepiece respirator with a high-efficiency particulate filter or any appropriate escape-type self-contained breathing apparatus. [NIOSH] NONCARCINOGENIC Cr(VI): Up to 0.25 mg/m3: any dust and mist respirator except single-use and quarter-mask respirators or supplied air respirator or self-contained breathing apparatus. Substance reported to caus e eye irritation or damage; may require eye protection. Up to 0.625 mg/m3: any powered air-purifying respirator with a a high-efficiency particulate filter; or any supplied-air respirator operated in a continuous flow mode. Substance reported to cause eye irritation or damage; may require eye protection. Up to 1.25 mg/m3: any air-purifying respirator with a high efficiency particulate filter or any powered air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter. Substance reported to cause eye irritation or damage; may require eye protection. Any self-contained breathing apparatus with a full facepiece or any supplied-air respirator with a full facepiece. Up to 25 mg/m3: any supplied-air respirator with a half-mask and operated in a pressure-demand or other positive pressure mode. Up to 50 mg/m3: any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode. Emergency or planned entry in unknown concentration or IDLH conditions: any self-contained breathing apparatus with full facepiece and

operated in a pressure-demand or other positive pressure mode or any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus and operated in pressure-demand or other positive pressure mode. Escape: any air-purifying full facepiece respirator with a high-efficiency particulate filter or any appropriate escape-type self-contained breathing apparatus. [NIOSH: POCKET GUIDE TO CHEMICAL HAZARDS, APPENDIX B, 1987]

STORAGE

NONE

CHROMIUM (VI) P. 8 (1976) DHEW PUB. NIOSH 76-129]
Upper limit respirator devices permitted: up to 5 mg/m3: high-efficiency particulate respirator with a full facepiece; or supplied-air respirator with a full facepiece, helmet, or hood; or self-contained breathing apparatus with a full facepiece. Up to 30 mg/m3: powered air-purifying respirator with an organic vapor cartridge and a high-efficiency particulate filter with a full facepiece; or type C supplied-air respirator with a full facepiece, operated in pressure-demand or other positive pressure mode, or with a full facepiece, helmet, or hood, operated in continuous-flow mode. Escape: High-efficiency particulate respirator; or self-contained breathing apparatus. Chromic acid and chromates. [NIOSH; POCKET GUIDE TO CHEMICAL HAZARDS P. 69 (1981) DHEW (NIOSH) PUB NO. 78-210]
Laboratory protective equipment: goggles; lab coat; vent hood. Eye/skin protection: recommended.

STORAGE

Storage color code: blue (health). Special precautions: keep container tightly closed. Store in secure poison area.